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Microbes are amazingly diverse in terms of the reactions that they catalyze. This diversity can be exploited to create competitive biotechnological solutions for many environmental challenges, where the right combination of existing microbial reactions can convert unwanted pollutants into a useful or harmless end-product. There are, however, significant scientific and technical challenges in order to combine potentially useful microbial reactions into a workable biotechnology, especially for processes that require the cooperation between microbial groups with very different properties and preferences. Simple empirical approaches often fail, and our intent is therefore to ***rationally*** manipulate the composition, that is, the microbial diversity of such systems, towards a target performance. Our hypothesis is that ***controlled*** biofilm or bioaggregate-based systems, wherein microbes grow in spatially structured assemblies, are suitable to harness these microbial potentials. We specifically aim to develop, implement and validate the feasibility of generic approaches for the rapid and efficient selection and management of the microbial composition ***and*** the micro-scale structure (micro^2-management) of biofilms and bioaggregates for a target performance goal. These approaches are being implemented for the rapid start-up and high-rate operation of membrane-supported biofilm reactors and granular biomass reactors to attain a community consisting of aerobic and anaerobic ammonium oxidizing bacterial guilds (AeAOB and AnAOB) for autotrophic nitrogen (N) removal from wastewaters.

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